

IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF TEXAS  
FORT WORTH DIVISION AUG 14 2019

UNITED STATES OF AMERICA  
v.  
BO MAO (01)

CLERK U.S. DISTRICT COURT  
By: \_\_\_\_\_

No. 4:19-MJ-647

CRIMINAL COMPLAINT

Melissa R. Markert, being duly sworn, deposes and states that she is a Special Agent with the Federal Bureau of Investigation (“FBI”), duly appointed according to law and acting as such.

Between approximately 2016 and the date of this Complaint, within the Northern District of Texas and elsewhere, the defendant **BO MAO**, together with others, did knowingly and intentionally conspire to devise a scheme and artifice to defraud a U.S.-based technology company (the “Victim Company”), and to obtain property from the Victim Company, by means of one or more materially false and fraudulent pretenses, representations and promises, and for the purpose of executing such scheme and artifice, to transmit and cause to be transmitted by means of wire communication in interstate and foreign commerce, writings, signs, signals, pictures and sounds, contrary to 18 U.S.C. § 1343.

All done in violation of 18 U.S.C. § 1349.

The source of your deponent’s information and the grounds for her belief are as follows:<sup>1</sup>

<sup>1</sup> Because the purpose of this Complaint is to set forth only those facts necessary to establish probable cause to arrest, I have not described all the relevant facts and circumstances of which I am aware.

1. I am a Special Agent with the FBI and have been so employed since 2015. As a Special Agent with the FBI, I am responsible for conducting and assisting in investigations involving various criminal laws, including theft of trade secrets, bank fraud, wire fraud, money laundering and the International Emergency Economic Powers Act, among others. I have participated in investigations involving search warrants, seizure warrants and arrest warrants. As a result of my training and experience, I am familiar with the techniques and methods used by individuals and criminal enterprises involved in these crimes worldwide and the methods they use to avoid law enforcement detection.

I. The Defendant and the Victim Company

2. The defendant BO MAO is a citizen of the People's Republic of China ("PRC"). Since approximately August 2015 and continuing through the present, BO MAO has been employed as an associate professor at the "Advanced Storage Technology Lab" at a research university in the PRC. Since the fall semester of 2018, BO MAO has also worked at a research university located in the Northern District of Texas (the "Texas University") under the supervision of a tenured professor in the field of computer science and engineering ("Professor 1"). Based on my investigation, it appears that BO MAO and Professor 1 had a professional relationship preceding BO MAO's employment with the Texas University.

3. The Victim Company is a technology company headquartered in the Northern District of California that develops architecture for controllers for solid state drives ("SSDs").

An SSD is a storage device that uses integrated circuit assemblies as memory to store data in semiconductor cells. As compared to electromagnetic storage drives, SSDs are typically more resistant to physical shock, run silently and have quicker access time and lower latency, that is, the time lag before data transfer commences. An SSD controller—sometimes referred to as a processer—executes the software that controls the SSD's hardware and is one of the most important factors in SSD performance. In particular, the Victim Company is the leader in the field of Open-Channel SSD controller technology (“Open-Channel”). In contrast to other SSD controller technologies, in which management of storage occurs within the SSD, Open-Channel leaves management of storage to the host computer’s operating system.

4. As of late 2016, the Victim Company was the only company to have developed a computer board with an embedded software development kit (“SDK”) that includes an integrated chip containing the Open-Channel controller (the “Open-Channel SDK Board”). Using an Open-Channel SDK Board, a researcher could perform issue spotting or develop new solutions with respect to the Victim Company’s Open-Channel technology and thus improve the Open-Channel technology ecosystem for future marketing of Open-Channel products and services. The Victim Company’s Open-Channel SDK Board was not available for public purchase. As the Open-Channel SDK Board contained its intellectual property—including proprietary software and hardware—the business practices and policies of the Victim Company required third parties to enter into licensing and non-disclosure agreements before taking possession of any Open-Channel SDK Boards from the Victim Company.

II. The Fraudulent Scheme

5. Since no later than 2016, a telecommunications conglomerate (“Company 1”) based in the PRC has attempted to misappropriate the Victim Company’s Open-Channel technology. As part of this fraudulent scheme, the defendant BO MAO entered into a licensing and non-disclosure agreement (the “Agreement”) with the Victim Company to obtain an Open-Channel SDK Board, purportedly for the purpose of conducting academic research related to such technology. Pursuant to the Agreement, BO MAO falsely represented that he would not disclose or transfer the Open-Channel SDK Board to third parties (such as Company 1); that he would not study the Open-Channel SDK Board for the purpose of developing a similar or competitive product; and that he would not engage in either the reverse engineering of or modifications to the Open-Channel SDK Board. To the contrary, however, BO MAO violated the terms of the Agreement and used his access to the Open-Channel SDK Board to benefit Company 1, for whom he was doing work, including on what appears to be a similar product. The defendant BO MAO did not disclose to the Victim Company that he was doing work for Company 1.

A. Relevant Background

6. As of June 2016, Company 1 did not have Open-Channel technology that was as advanced as the proprietary Open-Channel technology developed by the Victim Company. An employee of Company 1—who is described on Company 1’s official website as the “chief architect” of Company 1’s data storage unit—admitted as much during a recent civil trial in the Eastern District of Texas related to a litigation between Company 1 and the Victim Company (the “Civil Trial”).

7. On or about October 17, 2016, a fully-owned U.S. subsidiary of Company 1 pledged a \$100,000 gift to the Texas University to support a research project headed by Professor 1 titled “Enforcing Xth Percentile Latency and Throughput SLOs under Consolidated Datacenter Resources.” Payment of the grant was made on or about December 21, 2016. Based on information made available to me through the investigation, I understand that Open-Channel technology is one way to achieve the ostensible goal of this research project. As a result, proprietary technology of the Victim Company would have directly benefited Professor 1’s project.

8. In or about December 2016, the defendant BO MAO and Professor 1 each separately contacted the Victim Company seeking to purchase an Open-Channel SDK Board featuring the Victim Company’s proprietary technology, purportedly for research purposes. Indeed, a transcript from the Civil Trial reveals that BO MAO emailed a Victim Company employee and stated that “[w]e would like to buy 1 [Open-Channel SDK Board] to build an experimental platform and conduct storage system research....” In their communications with the Victim Company, BO MAO and Professor 1 did not disclose their collaboration with one another or their relationships with Company 1. However, an email dated on or about December 20, 2016 from BO MAO to Professor 1 reveals close coordination in their efforts to obtain Open-Channel SDK Boards from the Victim Company:

I also contact [Victim Company] branch in [the PRC] and get the information that the 1st version of Open-Channel SSD [S]DK will be released in Q2 2017. However, if the USA’s side can provide the SDK right now, that would be great and [Professor 1’s associate] can bring it to China.

Additionally, BO MAO asked Professor 1 to “keep the receipt and payment record of the credit card, I will transfer the costs to you directly.”

9. The Victim Company agreed to provide Open-Channel SDK Boards to both the defendant BO MAO and Professor 1. The Victim Company hoped that by providing these boards for research purposes, its products and services would become more marketable if academics performed issue spotting with respect to or developed solutions based on its proprietary Open-Channel technology, and thus improved the Victim Company’s Open-Channel technology ecosystem. Ultimately, however, Professor 1 did not follow through on his request for an Open-Channel SDK Board, and the Victim Company did not provide one to him. The Victim Company did provide an Open-Channel SDK Board to BO MAO pursuant to the Agreement, as detailed below.

10. Although Professor 1 did not follow through on his request for an Open-Channel SDK Board, in or about May 2017, the Victim Company negotiated a licensing and non-disclosure agreement with another professor at the Texas University (“Professor 2”). The agreement with Professor 2 contained substantially the same terms as the Agreement with the defendant BO MAO, including prohibitions regarding transfer of the technology to third parties. On or about May 31, 2017, Professor 2 submitted a purchase order and payment to the Victim Company for two Open-Channel SDK Boards, which were shipped to the Texas University in mid-July 2017. Notably, Professor 2’s official university webpage reflects a 2019 publication co-authored with Professor 1 on the topic of data caching.

B. The Agreement and Delivery of the Board to the Defendant BO MAO

11. The defendant BO MAO and the Victim Company each signed the Agreement, which became effective in or about February 2017 and gave BO MAO access to an Open-Channel SDK Board. In relevant part, the Agreement, which was transmitted by wire communication between the Northern District of California and the PRC, prohibited, among other things: (i) the “direct[] or indirect[] … transfer” of “rights or usage” in the Open-Channel SDK Board and its underlying technology to third parties (such as Company 1); (ii) the “study” of the Open-Channel SDK Board and its underlying technology “for the purpose of developing a product which is similar to or competitive with” the Open-Channel SDK Board; (iii) the “modif[ication], translat[ion] or creat[ion] of derivative works based on” the Open-Channel SDK Board; and (iv) the “disclos[ure], divulg[ence] or public[cation]” of the Open-Channel SDK Board and its underlying technology. As part of the Agreement, the Victim Company provided BO MAO with a specific product number (the “Product Number”) for its Open-Channel SDK Board as well as the name of the Victim Company’s PRC-based distributor of the board (the “Distributor”).

12. Delivery of the board was delayed after execution of the Agreement. During this period, the defendant BO MAO repeatedly contacted the Victim Company by electronic communication to ask for the board, claiming that his research had to be completed during a specific time window when students were available. The Victim Company ultimately provided an Open-Channel SDK Board to BO MAO pursuant to the Agreement in April 2017.

13. The Open-Channel SDK Board provided to the defendant BO MAO was the first such board that the Victim Company provided in the PRC to an academic for research purposes. Had BO MAO disclosed to the Victim Company his relationship with Company 1—which is a direct competitor of the Victim Company in the field of SSD controller technology—the Victim Company would not have agreed to provide an Open-Channel SDK board to him.

C. The Defendant BO MAO's Misappropriation of the Victim Company's Technology in Violation of the Agreement

14. Review of the defendant BO MAO's emails from this time frame reveals that he was surreptitiously working for payment on behalf of Company 1 to misappropriate the Victim Company's Open-Channel technology in violation of the Agreement. For example, on or about April 10, 2017, BO MAO wrote to an employee of Company 1, who according to open-source records is Company 1's "SSD Application Department Manager" ("Co-Conspirator 1" or "CC-1"). In the email, BO MAO attached a preliminary research proposal, noting "[t]he current dilemma is that the equipment is not yet available," which I believe to be a reference to the Open-Channel SDK Board. BO MAO further indicated that the Victim Company "received an order to arrange delivery" and that "we also began to arrange remote use of the development board that has been put in place in the US partner universities through SS[D] to see if there is some feedback,"<sup>2</sup> indicating that BO MAO was informing Company 1 of his progress in obtaining the

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<sup>2</sup> The emails between the defendant BO MAO and Company 1 were originally in Mandarin Chinese and have been translated. These translations are in draft form and are subject to change.

Victim Company's Open-Channel technology. On or about April 17, 2017—approximately one week later and around the time that he received the Open-Channel SDK Board from the Victim Company—BO MAO replied in the same email chain to CC-1, attaching “the latest updated design document version 2.0.” The attachment itself is unavailable in the email chain I have reviewed, but based on the context of the email, I believe the attachment likely pertains to the Victim Company's Open-Channel technology.

15. In or about May 2017—several weeks after receiving the Open-Channel SDK Board—the defendant BO MAO contacted the Victim Company and stated that the board was damaged by a student who had mishandled the board. Upon the Victim Company's request, BO MAO sent pictures of the damaged board, which showed that a connector to the proprietary chip had been detached from the board. I have interviewed an experienced professional in the technology sector who is familiar with boards used to host SSD architecture technology. This person informed me that he/she has never broken such a board in the manner BO MAO claimed and believes that it is almost impossible to accidentally do so.

16. On or about June 18 and 21, 2017, the Distributor alerted the Victim Company that purchasers for Company 1 had contacted the Distributor to purchase the same Open-Channel SDK Board provided to the defendant BO MAO pursuant to the Agreement, and provided the Product Number. According to emails sent from Company 1 to the Distributor, these requests were made on behalf of CC-1.

The Victim Company kept confidential the Product Number and the identity of the Distributor because, if this information were publicly disclosed, any competitor of the Victim Company could attempt to purchase an Open-Channel SDK Board containing the Victim Company's proprietary technology, which was not yet available for public purchase, and attempt to reverse engineer the Victim Company's source code. For example, by directly contacting the Distributor and providing the Product Number, one of the Victim Company's competitors could theoretically dupe the Distributor into mistakenly releasing an Open-Channel SDK Board containing the Victim Company's proprietary technology.

17. The Victim Company found the emails from Company 1 to the Distributor to be highly alarming because they suggested that the Product Number and the identity of the Distributor were likely provided to Company 1 by a university with which the Victim Company had recently established a relationship. As of July 2017, the only academic in the PRC to receive an Open-Channel SDK Board was the defendant BO MAO.<sup>3</sup> Moreover, BO MAO was the only academic to whom the Victim Company ever provided both the Product Number and the identity of the Distributor.

18. Accordingly, in or about July 2017, an employee from the Victim Company telephoned the defendant BO MAO to ask whether he provided the Victim Company's confidential information to Company 1, including the Product Number.

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<sup>3</sup> The Victim Company had distributed other Open-Channel SDK Boards to academics in the United States; however, those boards were not sent from the PRC-based Distributor, but rather from a distributor in the United States. The Victim Company entered into a licensing agreement with one other academic in the PRC, but never ultimately provided an Open-Channel SDK Board to that academic.

BO MAO denied providing this information to Company 1. Additionally, an employee from the Victim Company called CC-1 and asked why Company 1 had contacted the Distributor when it could have easily contacted the Victim Company directly. He also asked how Company 1 learned the Product Number. CC-1 did not respond to these questions, other than to say that Company 1 was potentially interested in using third party products, such as those of the Victim Company, in its own equipment. Thereafter, on or about July 13, 2017, the Victim Company informed BO MAO that he would no longer receive technical support for the Open-Channel SDK Board, which meant that BO MAO would no longer receive, among other things, information about modifications or changes in functionality to, software upgrades for or production schedules for the Open-Channel SDK Board.

19. On or about August 3, 2017, the defendant BO MAO emailed Professor 1, asking to “use the Open-Channel SSD for evaluation for one week. I have talked to [Professor 1’s intern] and he said that we cannot remotely access the server. . . we have worked on [Open-Channel SSD] for nearly 4 month.” In response, Professor 1 agreed to provide BO MAO with remote access to the Texas University’s server. I believe BO MAO’s reference to his work on Open-Channel SSD for “nearly 4 month” refers to his work with the Open-Channel SDK Board provided by the Victim Company to BO MAO nearly four months earlier, in April 2017. Notably, BO MAO made this request for remote access from Professor 1 shortly after the Victim Company ceased providing him with technical support with respect to the Open-Channel SDK Board.

20. It is unclear how Professor 1 would have maintained an Open-Channel SSD platform without using the Victim Company's technology, as the Victim Company was the only company that offered Open-Channel SDK Boards at the time. However, as detailed above, while Professor 1 never actually received an Open-Channel SDK Board from the Victim Company, Professor 2—who was also at the Texas University—did receive two Open-Channel SDK Boards from the Victim Company. In connection with those boards, Professor 2—and by extension, the Texas University—would have had access to technical support from the Victim Company.

21. Based on a review of the defendant BO MAO's email correspondence and of transcripts from the Civil Trial, it is clear that BO MAO secretly provided the Victim Company's proprietary information to Company 1 in violation of the Agreement. For example:

- a. Emails between BO MAO and Company 1 beginning no later than May 2017 and continuing throughout 2017 reveal that Company 1 directed BO MAO's research on Open-Channel technology and conditioned payment upon satisfaction of certain deliverables:
  1. On or about May 8, 2017, just one month after the Victim Company provided the Open-Channel SDK Board to BO MAO, a Company 1 employee wrote to BO MAO and one of BO MAO's associates, promising "acceptance payments[] delivered as follows: 1. Garbage collection perception of flash memory research project." Based on my training and experience, in computer science, "garbage collection" is a form of automatic memory management. As explained by an experienced professional I interviewed who is familiar with this process, garbage collection requires knowing the location and purpose of every object within the device in order to enable this

automatic collection of unused memory. As a result, understanding garbage collection would be a key first step in attempting to reverse engineer the Open-Channel SDK Board. The experienced professional further explained to me that the damage to BO MAO's board that BO MAO stated happened when a student mishandled it, as further detailed below, was possibly consistent with attempting to understand garbage collection for the Open-Channel SDK Board.

2. On or about August 2, 2017, BO MAO emailed an Excel spreadsheet containing test results to CC-1. CC-1 responded on the next day, with a list of questions concerning SSD storage benchmarks. On the same date, BO MAO responded with answers concerning Open-Channel SSD. Based on my review of the email communication, it appears that this email relates to tests performed on an Open-Channel SDK Board.
3. In an email dated on or about September 24, 2017, CC-1 asked BO MAO about certain design tradeoffs in SSD architecture design.
4. In an email dated on or about September 25, 2017, BO MAO wrote to CC-1 addressing potential design tradeoffs in SSD architecture design.
5. On or about November 2, 2017, an employee of Company 1 wrote BO MAO, stating that Company 1 would assess BO MAO's testing and then move to the second phase of BO MAO's work with Company 1.
6. On or about November 30, 2017, BO MAO wrote to multiple Company 1 employees who had sought his input on a flash media project, stating "I am currently working with [Company 1] on an SSD-related project."
7. In addition, according to the transcript of the Civil Trial, on or about June 29, 2017, BO MAO emailed a PowerPoint presentation to CC-1.

The PowerPoint presentation, which includes a photograph of the Victim Company's Open-Channel SDK board, states “[i]t is proposed to purchase another block to enable parallel development, testing and research.” I believe that BO MAO's reference to “another block” refers to another Open-Channel SDK board from the Victim Company and that “parallel development” refers to reverse engineering the Victim Company's Open-Channel SDK board on behalf of Company 1. As set forth above, the Agreement between BO MAO and the Victim Company expressly prohibited him from attempting to reverse engineer the Open-Channel SDK Board.

8. On or about August 27, 2017, BO MAO emailed a document to Company 1 personnel, including CC-1. The document, which BO MAO characterized as a “system design and system preliminary result document,” stated that the goal was “to use [Company 1's] technical cooperation with universities to make full use of the accumulated experience and achievements of universities in the SSD field, to quickly build [Company 1's] technical capabilities to cope with new changes in the SSD field, and to advance key technologies.” The document included detailed descriptions of the Open-Channel SDK Board, as well as a description of how the software interacted with the platform and a description of the commands to the controller. BO MAO's provision to Company 1 of a description of the Open-Channel SDK Board, as well as information learned from analysis of the board, was contrary to the representations BO MAO made in the Agreement. Based on my review of evidence, it appears that BO MAO was designing for Company 1 a prototype which would require as a component an Open-Channel SDK Board.

22. In early 2019, the Victim Company requested and received the damaged SDK board from the defendant BO MAO. I have consulted with an expert witness<sup>4</sup> who has examined the damaged Open-Channel SDK Board returned by BO MAO, which had a removed connector attached to the board with green wiring. According to the expert witness, inspection of the connector revealed that its resistors—which connected the controller to the board—had been carefully removed from the connector. This finding conflicts with BO MAO’s statement to the Victim Company that the Open-Channel SDK Board had been damaged by a student who mishandled it. Moreover, the expert witness opined that the fact that the Open-Channel SDK Board was returned with wires attached to the removed connector indicates that persons in possession of the Open-Channel SDK Board attempted a hack of the SDK board. Indeed, the expert witness characterized the connector as the gateway to the chip which houses the proprietary source code of the Victim Company. Notably, at the Civil Trial, CC-1 testified that “[b]ased on the cooperation project requirements between [Company 1] and [BO MAO’s university], [BO MAO’s university] needs to provide source codes and design reports pertaining to the development of that project to [Company 1], and [Company 1] needs to verify the delivery—the delivery from [BO MAO’s university].”

23. On or about June 27, 2019, the Civil Trial culminated in a finding by the jury that Company 1 had misappropriated the Victim Company’s intellectual property; however, the jury did not award any monetary damages.

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<sup>4</sup> The expert was retained by the Victim Company during the Civil Trial.

On or about July 2, 2019, the defendant BO MAO wrote an email, to Professor 1 stating, "For the law case, it is finally judged on the jury verdict. Based on the judgment, both sides take nothing and their case against each other is dismissed with prejudice. We learned from the law case and hope it does not disturb us anymore." I believe BO MAO was referencing the litigation between the Victim Company and Company 1.

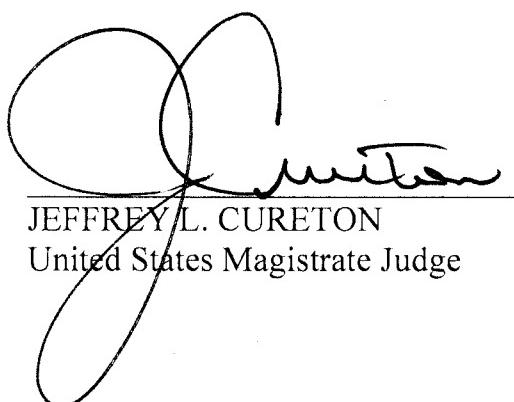
III. Conclusion

24. Based upon the above facts and circumstances, I respectfully submit that there is probable cause to believe that Bo Mao devised a scheme to defraud U.S.-based technology company (the "Victim Company"), and to obtain money and property by means of materially false and fraudulent pretenses, representations and promises, and for the purpose of executing that scheme, he caused to be transmitted by means of wire communication in interstate commerce certain signals and sounds, contrary to 18 U.S.C. § 1343. All done in violation of 18 U.S.C. § 1349.



Melissa R. Markert  
Special Agent, Federal Bureau of Investigation

SWORN AND SUBSCRIBED before me, at 9:10 am, this 14<sup>th</sup> day  
of August 2019 in Fort Worth, Texas.



JEFFREY L. CURETON  
United States Magistrate Judge